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A Sustainability Strategy for Energy

A report to the citizens of British Columbia
March, 1992

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Preface

A Sustainability Strategy for Energy is one element of the sustainability strategy for British Columbia which is being developed by the Round Table on the Environment and the Economy.

Sustainability is the key to our future quality of life. In *Towards A Strategy for Sustainability*, the Round Table described how it is developing such a strategy for British Columbia. Using a consensus-based approach, the Round Table is bringing together the interests, experience and ideas of people in every region and economic sector. Since a strategy for sustainability must encompass environmental, economic and social perspectives, the Round Table has chosen to develop the broad overall strategy as a series of sectoral strategies. *A Sustainability Strategy for Energy* is the first of these.

A Sustainability Strategy for Energy is based on the input of many British Columbians through submissions to the Round Table and discussions at public forums and workshops. Its content reflects a consensus by the Sustainable Development Strategy Core Group of the Round Table.

The paper presents the Core Group's preliminary recommendations on those energy issues which are considered important to achieving overall sustainability, with the exception of energy in transportation which will be covered in a separate report in the near future.

The Core Group invites your comments on this paper and its recommendations so that these can be presented to the entire Round Table. After considering your submissions, the Round Table will present its final recommendations to government.

I invite you to share your views with the Round Table.

Bryan Williams, QC
Chairman, Sustainable Development Strategy Core Group

CHAPTER 1

Introduction

Developing a Strategy for Sustainability

The Round Table on the Environment and the Economy is charged with producing a sustainability strategy for British Columbia. This strategy must find ways to meet today's needs without compromising options for the future. This means achieving a balance between our economic, environmental and social goals.

In the 1992 publication *Towards a Strategy for Sustainability*, the Round Table outlined the process being used to develop this strategy. Sustainability issues in selected sectors were first identified through a series of workshops held in 1990. In the Round Table publication *A Better Way*, these issues were introduced to the general public along with a number of sustainability principles. Four Round Table theme papers, supported by 12 background reports, provided a detailed discussion of major sustainability issues and themes: energy, land and water use, communities, and economic measures. These provided the basis for discussions at public forums that were held in 26 communities around the province in mid-1991.

This strategy must find ways to meet today's needs without compromising options for the future.

Towards a Strategy for Sustainability reports on the public forums, provides a vision of a sustainable future and reviews the sustainability principles based on the public input received. It also presents initial recommendations to government and outlines the process that will be used by the Round Table to finalize the sustainability strategy.

Elements of a Sustainability Strategy

The overall sustainability strategy will be built from several elements. The first of these elements to appear for public discussion is this *Sustainability Strategy for Energy*. Similar sustainability strategies for transportation and urban planning, land and water use, communities, education and the economy will soon follow.

Each of the elements will be published separately as soon as it is completed, and public comment on the recommendations will be invited.

These elements will then be integrated into an overall sustainability strategy for British Columbia, which will be published as a final, comprehensive document.

The Round Table is committed to providing the public an opportunity to comment on its draft recommendations before submitting final recommendations to government. This commitment to public involvement and to the Round Table's principles for sustainability has led to stakeholder and public collaboration in the development of these strategies.

The Round Table is committed to providing the public an opportunity to comment on its draft recommendations before submitting final recommendations to government.

In preparing to address energy sustainability, the Round Table held an energy workshop in September 1990 to identify and discuss the main issues with energy experts. The theme paper *Sustainable Development and Energy* was prepared as a public discussion document, leading to the public forums that were held in mid-1991. The energy issues which emerged were debated by the Sustainable Development Core Group of the Round Table, and the tentative recommendations were subjected to detailed discussion in a workshop with stakeholders held on November 30 and December 1, 1991. Further deliberations of the Core Group resulted in this current document.

Public Involvement

A Sustainability Strategy for Energy is being distributed to all those who attended the Round Table's energy workshops and public forums, and to other interested individuals and groups.

The Round Table's Sustainable Development Core Group invites your comments on this document and its draft recommendations. All comments will be reviewed by the Core Group and by the Round Table as a whole before final recommendations on an energy sustainability strategy are submitted to government. Details about how you can contact us are provided at the back of this document.

What is an Energy Sustainability Strategy?

This document outlines a series of recommendations intended to:

- address all the important energy sustainability issues;
- be mutually consistent and supportive; and
- lead to a set of actions whose implementation would set the province on the road to a sustainable energy future while maintaining a viable economy.

It is important to recognize that this strategy focuses on *sustainability* issues. The workshops and public forums raised a wide variety of issues, but the Core Group has used the Round Table's sustainability principles as a test to determine whether any particular issue raises a sustainability question.

This strategy is not a policy. As a strategy it identifies goals and how to move towards them from where we are at the present time. It does not give direction on how a particular organization should incorporate these actions into its activities. Those are policy concerns to be considered after the strategy is established.

Each of us will have to consider how this strategy affects us as individuals and how it affects society as a whole. If the strategy evokes positive responses leading to real actions, then it can and will be effective.

Sustainability in Energy

Energy performs the world's work. Natural gas, petroleum, coal, hydroelectricity, wood, nuclear energy, and a variety of alternative sources of energy provide the basic services used by all economies. Such services include space and water heating, refrigeration, lighting, transportation, process heat in commerce and industry, communications and computation.

British Columbia's energy supplies have been an important factor in economic growth and industrial development in the province. Today, the energy sector itself is a significant part of the economy, although its contribution is less than that of forestry, mining or tourism. Energy-intensive resource-based industries account for nearly 50 per cent of all energy consumed in the province. Employment in the energy sector — electricity, gas utilities, oil, and coal mining — was estimated at about 20,000 jobs in 1990.

The value of total energy sales, including coal exports, totalled $7.4 billion in 1989, which represents about 10 per cent of the provincial domestic product. Of this total, almost $2.0 billion came from direct energy exports. This value does not include the substantial energy that is used in the production of energy-intensive export commodities such as aluminium, petrochemicals, pulp, zinc and copper. Additionally, direct government revenues from B.C. energy production and use totalled $1.2 billion annually in 1989.

Each of us will have to consider how this strategy affects us as individuals and how it affects society as a whole.

Most of our modern services are simply ways of using energy. This dependence automatically makes sustainability a concern with energy. Other related concerns are the need to use fossil fuels wisely, the anticipated growth in demand for energy and the fact that environmental impacts occur with all forms of energy.

British Columbia relies heavily on fossil fuels (*see Figure 1*), and by using them we draw down fixed stocks which, over the long term, can ultimately run out. British Columbia has only a 10 year domestic reserve of oil and currently imports 81 per cent of its requirements from Alberta. The province has an anticipated 20 to 70 year supply of natural gas, and a supply of coal that would last 500 years at current production rates. Many areas of the province are virtually unexplored for natural gas, and coal bed methane is another option with significant potential. Thus sustainability of supply is not a major concern, but we must ensure that we are using these energy sources efficiently and wisely.

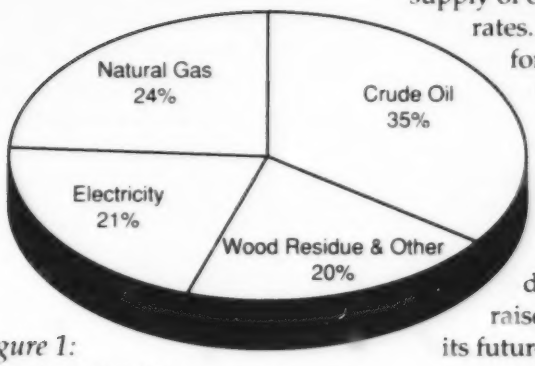

Figure 1: British Columbia Energy Use by Fuel Type, 1990

Source: Ministry of Energy, Mines and Petroleum Resources, 1991

The enormous growth of energy requirements has cast doubt on the viability of traditional technologies and raises questions about how a sustainable society will meet its future energy needs.

The population of British Columbia is projected to increase by 50 per cent within the next 25 years. The provincial government forecasts that, between 1990 and 2010, our total energy requirements will grow at an annual rate of 1.4 per cent. The commercial and residential sectors are expected to lead this growth at 2.2 per cent and 1.8 per cent respectively. Natural gas and electricity requirements are projected to increase at a higher rate, an average of 2.3 per cent and 2.2 per cent respectively.

Energy conservation and efficiency programs alone may not be able to supply these electricity requirements. New supplies likely will be required from privately owned thermal and hydroelectric generation projects and major hydroelectric developments such as BC Hydro's Peace Site C dam. The issue is not whether we need new energy supplies, but rather when they should be developed and what kind they should be.

A sustainable energy strategy must recognize that important environmental impacts are caused by all phases of energy: production, transportation or transmission and use. These impacts have in some cases become obstacles to further energy development.

All industrial economies are affected by these trends and concerns but they are particularly visible in British Columbia. In part, this is because energy is one of our main provincial exports, either directly or embodied in exported materials (*see Figure 2*). In addition, this province uses more energy per capita than almost any other jurisdiction in the world.

Selected Products	Energy Cost/ Value of Shipment	% of all 1989 Exports
Wood products	4 - 5 %	27.5%
Paper & allied	8 - 10 %	28.7%
Coal	6 - 8 %	8.5%
Copper concentrate	5 - 6 %	4.7%
Refined aluminum	15 - 20 %	2.9%
Refined zinc	8 - 10 %	2.5%

Figure 2: Energy Content of Selected Exports
Source: L. Sivertson, Ministry of Regional and Economic Development, 1990

The issue is not whether we need new energy supplies, but rather when they should be developed and what kind they should be.

Energy and the Sustainability Principles

The Round Table's principles for sustainability were first outlined in *A Better Way*. After discussion in the public forums and further refinement, the principles were elaborated in *Towards a Strategy for Sustainability*.

These principles have guided the development of the sustainability strategy for energy. They have acted as guides to thinking and as continuing reminders of the goals and imperatives of sustainability. The questions they lead to are fundamental, but sometimes the answers are still out of reach because the required information does not exist. This lack of answers is sometimes disturbing. A major concern is that we are taking risks in making decisions without knowing all of the consequences.

A sustainability strategy will assist all of us when we are making responsible energy decisions. The long-term stakes are enormous. In developing this energy strategy, the sustainability principles kept the crucial long term vision continually in mind while dealing with the hard, practical issues of today.

The sustainability principles, and some of the questions they raise in relation to energy follows. The principles are numbered for ease of reference, but the numbers do not reflect any order of importance.

In developing this energy strategy, the sustainability principles kept the crucial long term vision continually in mind while dealing with the hard, practical issues of today.

1. Limit our impact on the living world to stay within its carrying capacity.

This principle focuses on the carrying capacity of an ecosystem and its ability to renew itself in the face of impacts created by natural and human activities. For energy, the issues surrounding global warming are most closely associated with this principle, for example:

- What are the impacts on the atmosphere, locally and globally, of burning fossil fuels?
- Can we determine atmospheric carrying capacity on a local scale to avoid human and environmental health hazards, and on a global scale to avoid impacts on basic life support systems?
- Is there a limit to the number and size of hydroelectric dams and water reservoirs we can build if we wish to retain natural aquatic and terrestrial systems?

2. Preserve and protect the environment.

This principle focuses on conserving life support services and biological diversity, and holding use of renewable resources to sustainable levels. For energy, this is the most widely applicable principle, influencing issues in all categories, for example:

- Can hydroelectric sources be developed without causing adverse effects and loss of biological diversity, such as the drying up of estuaries or the loss of critical habitat?
- How do energy prices affect the rates of energy production and consumption?
- Although multiple, small-scale energy sources may reduce the need for transmission lines, is the net impact on local environments lessened?

3. Hold to a minimum the depletion of non-renewable resources.

This principle recognizes the benefits of retaining options for the future, using existing resources wisely within a global context. It also points out the need to develop and choose alternative and renewable energy sources whenever possible. For energy, this principle relates to energy conservation and alternatives and to energy planning and public involvement. For example:

- What efforts should British Columbia make to accelerate the transition to new energy sources? Over what time period? How can this transition be encouraged?

- What barriers are hindering the development of alternative and renewable energy sources?

4. Promote long-term economic development that increases the benefits from a given stock of resources without drawing down on our stocks of environmental assets.

This principle focuses on creating more value with the resources we are already producing and using. For the energy sector, the issues in energy exports and alternative technologies are associated with this principle. For example:

- How energy efficient is present technology in industry, in commercial facilities and in the home?
- Are there opportunities to add value to energy-intensive commodities that we currently produce?

5. Meet basic needs and aim for a fair distribution of the benefits and the costs of resource use and environmental protection.

This principle recognizes that we have basic requirements for energy and that the benefits and costs of its development and use must be shared fairly. This is a key principle in energy pricing and, beyond provincial boundaries, in global warming. For example:

- Are all sectors of society equally affected by present patterns of energy development and use?
- If the primary impacts of resource development (hydroelectric projects, fossil fuel development) are mostly borne by people living in interior areas of the province, while the benefits accrue mainly to people living in coastal cities, can the costs and benefits be balanced better?

6. Provide a system of decision-making and governance that is designed to address sustainability.

This principle recognizes that public values must be incorporated in all public decisions, including those that relate to energy. For the energy sector, this principle permeates energy planning and energy export issues, for example:

- What are the sources of public dissatisfaction with energy decisions and how can planning processes be made more acceptable?
- Are current energy trends and forecasts widely understood?

The Core Group has used the Round Table's sustainability principles as a test to determine whether any particular issue raises a sustainability question.

- Where are the key decision points in the development of energy forecasts and future policy?
- Who should be involved in making decisions about energy, and how?
- What changes are needed in institutions currently involved in energy decision-making?

7. Promote values and actions that support sustainability.

This principle focuses on better access to information, greater emphasis on education about sustainable development and innovative communications strategies. For energy, this principle is crucial to energy planning. It also has relevance to energy conservation and alternatives and to energy pricing, for example:

- How can the public be made more aware of present energy consumption levels and the related environmental costs?
- What are other jurisdictions, such as the U.S. and Europe, doing to encourage public understanding of energy related issues.
- Are public communications programs on energy efficiency, such as Power Smart and Fuel Smart successful? Are they working fast enough?

Balance and Trade-offs

To aim for sustainability is to aim for balance in our economic, environmental and social goals.

To aim for sustainability is to aim for balance in our economic, environmental and social goals. The expectations of present generations have to be balanced with the expectations for future generations. The desire for human benefits from resource use has to be balanced with the desire to maintain natural ecosystems.

The desire for participatory decision-making processes must be balanced with the desire for efficiency. The need for environmental regulation must be balanced with the need for a vigorous economy. Benefits in the short term have to be balanced with benefits in the long term. All these trade-offs are simply consequences of recognizing that we must achieve a balance. We have to decide.

The issues in this sustainability strategy for energy are those significant points on which we collectively need to strike a balance. The preliminary recommendations constituting this strategy are the Core Group's views on the best balance overall. The end result is a matter of collective judgment, however, and reasonable persons will differ on many points.

Energy Issues

From the Round Table's perspective, sustainability is the key to our energy future. In assessing the current situation, we are encouraged that the energy sector has taken some significant steps towards sustainability. However, there are still significant issues to be resolved. Based on the input received from the public and experts at workshops and public forums, the Core Group considers that the most important issues for energy sustainability fall into the following categories:

- **global warming** — responding to a global environmental issue that is strongly linked to energy use;
- **energy conservation** — improving the sustainability of energy use;
- **alternative energy technologies** — finding better ways of providing energy sustainably;
- **energy pricing** — seeking the correct values to help us make the right choices;
- **energy exports** — finding the right balance to optimize benefits; and
- **energy planning and public involvement** — providing a comprehensive framework for collective decisions.

For simplicity, each of these categories has been identified as a separate chapter in this report.

It should be noted here that energy in transportation is not included in this strategy because it is a major issue by itself. It will be the subject of a sustainability strategy to be prepared in the near future.

The issues in this sustainability strategy for energy are those significant points on which we collectively need to strike a balance.

CHAPTER 2

Global Warming

Background

Global warming threatens to be the world's most significant environmental problem. Increased temperatures of the magnitude now anticipated would likely have a major impact on life. It could affect water supplies, shift food-growing regions and forest belts, change fish and wildlife habitat, and increase the levels of the world's oceans.

The "greenhouse effect" in the earth's atmosphere is a natural process. "Greenhouse gases" such as carbon dioxide and water vapour act like a blanket around the earth, keeping the earth warmer than it would be otherwise. The problem is that human activities, such as clearing forests, burning fossil fuels and releasing chlorofluorocarbons (CFCs) from refrigeration units, are causing global concentrations of greenhouse gases to increase, resulting in the threat of increased warming.

Although it is clearly established that gas concentrations are increasing, it is not yet scientifically established that global temperatures are rising as a result. There continues to be uncertainty about the magnitude and rate of global warming and about regional climate changes. However, the international consensus is that global warming will occur. Based on contributions of 170 scientists from 25 countries, the Intergovernmental Panel on Climate Change (IPCC) concluded that global mean temperature will rise about one degree Celsius by 2025 and three degrees Celsius before the end of the 21st century if emissions of greenhouse gases continue to increase at present rates.

This rate of temperature increase will be greater than any experienced over the past 5,000 years. If actions are taken to reduce emissions, global warming will also be reduced. However, because of the long lifetime of greenhouse gases, some global warming is considered inevitable.

"We now have developing internationally a strong consensus that greenhouse warming will take place over the next century or so. It will take place at a rate of climate change that is unprecedented in the last 5,000 to 7,000 years."

Gordon McBean
UBC professor and
Chairman
International Scientific
Committee for the World
Climate Research Program
(Submission)

"Show leadership by demanding some strong measures to reduce the emissions of all greenhouse gases from all sources including: tougher building codes to conserve energy, better fuel efficiency for motor vehicles, tougher emission controls for vehicles and industry of all sizes, promotion of mass transit, pricing structures that will encourage conservation–not consumption–of energy and curtailment of slash burning."

Otto Langer
Association of
Professional Biologists
(Submission)

Land surfaces will warm more than the oceans and high northern latitudes will warm more during winter than the global average. Precipitation will generally increase but there will be major regional variations. The sea level is expected to rise about 20 cm by 2030, and 65 cm by the end of the century.

Taking Action

The conclusions of the IPCC were endorsed by the Second World Climate Conference, held in Geneva in November 1990 and attended by participants from 116 countries. The Second World Climate Conference concluded that "notwithstanding scientific and economic uncertainties, nations should now take steps towards reducing sources and increasing sinks of greenhouse gases through national and regional actions, and negotiation of a global convention on climate change and related legal instruments."

At that Conference, the Canadian Minister of Environment committed Canada to stabilizing national emissions of all non-CFC greenhouse gases at the 1990 levels by the year 2000 as part of a national strategy on global warming. The provincial government is participating in developing the national action strategy and is developing control strategies.

Canada's emissions of greenhouse gases are among the highest per capita in the world. British Columbia contributes much more than its share (about 0.5 per cent) of global carbon dioxide emissions. Half of British Columbia's carbon dioxide emissions are due to the combustion of gasoline, diesel fuel and natural gas. Combustion of wood and pulping liquors are also major sources. Thus, the energy sector must be part of the solution to this problem.

One of the uncertainties about global warming is the appropriate time to take action. It cannot be proven that the observed global warming over the past century is due to the increase in greenhouse gas concentrations. However, scientists warn that greenhouse warming will occur. An important factor is the slow response of the earth's climate system to emission changes that we might make. If action is delayed, future emission reductions will have to be larger to achieve the same impact on the climate. The question is whether we should act now, even though we do not know the magnitude or timing of the anticipated warming.

Controlling British Columbia's Greenhouse Gas Emissions

There is strong international pressure to take significant action on greenhouse gas emissions and several countries have made unilateral declarations that go beyond stabilization. Denmark, Germany, Italy and New Zealand have set a target of 20 per cent or greater reduction in carbon dioxide emissions by 2005. Australia has adopted the target of 20 per cent reduction of non-CFC greenhouse gas emissions by 2005. The United Kingdom has set a target of retaining 1990 levels of carbon dioxide emissions by 2005 if other countries adopt similar action. The United Kingdom will also reduce other greenhouse gas emissions and expects to achieve a 20 per cent reduction in greenhouse warming potential of all national emissions by 2005 as compared to 1990 levels.

The United States has made no commitment towards stabilization or reduction in either carbon dioxide or total greenhouse gas emissions. However, they argue that currently planned actions will result in total greenhouse gas emissions in the year 2000 that will be no higher than the 1987 levels.

Currently, Canada is participating in discussions leading to a Framework Convention on Global Climate Change which is expected to be signed during the United Nations Conference on Environment and Development in June 1992. Through this Convention, there would be further negotiations to limit emissions and increase natural uptake of greenhouse gases.

A Plan for British Columbia

Based on existing and anticipated commitments, British Columbia will be expected to reduce emissions of greenhouse gases. The Ministry of Environment, Lands and Parks is preparing a discussion paper to address the issue. However, at the present time the province does not have a strategy for reductions of these gases.

A strategy is needed to allow the least-cost steps to be taken first. Many complementary initiatives exist — for example in the area of energy conservation — that can be justified economically and environmentally on their own merits, but which also act to reduce greenhouse gas emissions. A "no regrets" strategy could encompass broad-ranging actions that are economically and environmentally beneficial on their own, even if the dangers of global warming do not fully materialize.

"The nations of the world have given support for the need to adopt 'no regrets' measures to control manmade emissions of all greenhouse gases. The B.C. coal industry, through its industry association, the Coal Association of Canada, strongly supports this approach to developing response measures to global warming."

Peter Dolezal
B.C. Coal Industry
(Submission)

However, these actions on their own would not likely achieve the emission reductions that are being discussed internationally. The province needs to identify an "insurance" strategy, a series of steps with preferred least-cost reductions that could be implemented promptly to meet national or international commitments.

Fair distribution of the costs and benefits of environmental protection — especially between developed and developing countries — is a concern.

Atmospheric researchers predict that, even with implementation of aggressive measures to reduce greenhouse gas emissions, some global climate change is inevitable. Given this province's economic dependence on its environmental and resource base, it would be prudent to start considering how to deal with the economic, environmental and social changes that would be necessary to adapt to a changed climate. A provincial strategy for living with global warming should be part of the province's long-term planning.

Global warming is clearly a sustainability issue. In this case, the Round Table's principles that deals with carrying capacity — specifically the atmosphere's carrying capacity for greenhouse gases — is implicated. In addition, fair distribution of the costs and benefits of environmental protection — especially between developed and developing countries — is a concern.

The following reccommendations are made in consideration of the sustainability principles and the information discussed above:

Recommendation 1:
Government should prepare and immediately introduce a "no-regrets" strategy of cost effective actions to reduce emissions of greenhouse gases. Such actions might include:

- **improved energy efficiency and conservation;**
- **regulation of chlorofluorocarbons;**
- **increased reforestation;**
- **reduced dependence on oil;**
- **increased use of environmentally benign energy alternatives;**
- **international cooperation on greenhouse gas controls.**

Recommendation 2:
Government should prepare and implement within two years a strategy for significant reductions in greenhouse gas emissions by the year 2000.

Recommendation 3:
Government should encourage the development of a firmer understanding of climate change and should commence comprehensive planning to deal with the effects of global warming.

International Equity

A concerted international effort will be necessary to control the world's greenhouse gas emissions, most of which originate in developed countries. The developing countries understandably want the right to develop their economies, with the inevitable consequence of upward pressure on emission totals.

Industrialized countries such as Canada have skills and technology that could be exported to developing countries to help them reduce their emissions of greenhouse gases such as carbon dioxide. For example, cleaner coal technologies which act to increase energy efficiency and reduce emissions may be attractive to countries such as China which rely heavily on coal.

If it is agreed internationally that greenhouse gas emissions should be reduced, it might be more effective, economically and environmentally, for industrialized nations to develop and pay for reduction measures on pollution sources in developing countries, rather than focusing exclusively on new measures for domestic sources. Such actions would be consistent with the Round Table's sustainability principles.

Recommendation 4:
In developing plans for dealing with global warming, British Columbia should give special attention to what the province can offer internationally, such as the development and application of technologies to reduce emissions and to adapt to global warming.

It might be more effective, economically and environmentally, for industrialized nations to develop and pay for reduction measures on pollution sources in developing countries.

CHAPTER 3

Energy Efficiency and Conservation

Background

Conserving energy and using energy more efficiently to provide needed services are the cornerstones of any sustainable energy strategy. Today, energy efficiency is recognized around the world as one of the most effective and affordable means of controlling the environmental impacts of energy supply and use.

In this report we have sometimes used "conservation" in its broadest context to mean any kind of energy saving. However, a distinction should be made between energy conservation and energy efficiency. *Energy conservation* commonly refers to savings achieved by reducing

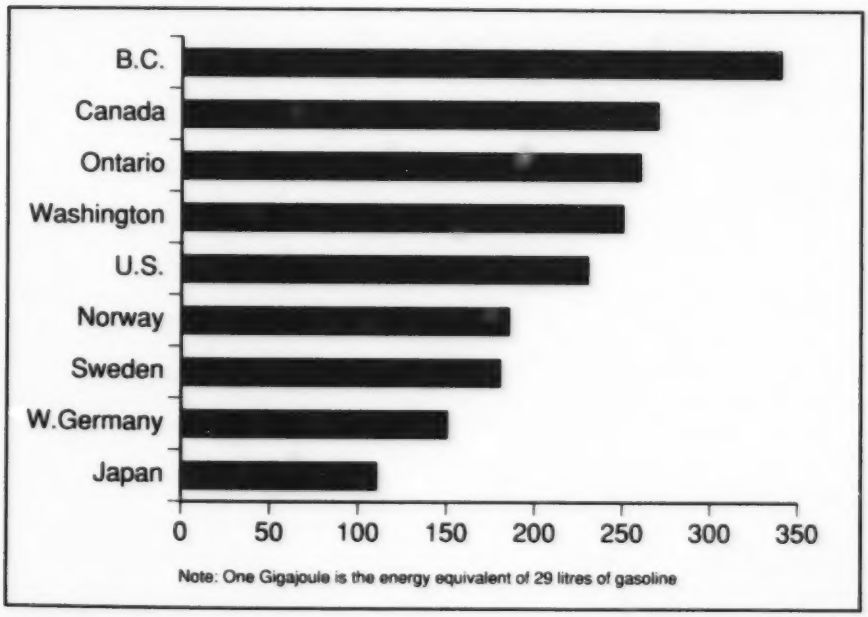

Figure 3:
Per Capita Energy Consumption (Gigajoules).

Source: Ministry of Energy, Mines and Petroleum Resources (1990)

"Energy conservation must be foremost in any sustainable development energy strategy."

Michael Margolick
Energy Consultant
(Submission)

consumption through lifestyle changes, such as using less lighting and relying less on automobiles. *Energy efficiency* refers to achieving the same level of services with a smaller expenditure of energy, for example through the use of better building insulation and more efficient motors and lighting.

"Energy conservation makes the B.C. economy more competitive in an increasingly competitive global marketplace."

John Duffy
B.C. Energy Coalition
(Submission)

British Columbia is a large consumer of energy. Although Canada as a whole is an energy-intensive society, our province used about 25 per cent more energy per capita than the Canadian average in 1989 *(see Figure 3)*. This energy use reflects the energy-intensive industrial base of the British Columbia economy.

An increasing population and a growing number of consumer amenities mean an ever-increasing demand for energy services. Energy is used by every individual at home, at leisure activities and at work. In a sustainable future there must be a shared responsibility among individuals, commerce, industry and government to do their parts in improving energy efficiency and conservation.

Initiatives in British Columbia

British Columbia's utilities are helping consumers to build sustainability into their energy decisions. The electric utilities' Power Smart program offers information and financial incentives to encourage electric efficiency improvements in buildings and equipment. BC Hydro's Resource Smart initiative is improving production efficiencies in existing generation and transmission facilities.

The province's largest natural gas distributor, BC Gas, is currently examining efficiency programs as part of its least cost supply plan. Additionally, the provincial government's Fuel Smart program and new appliance efficiency standards are showing people how to increase fuel efficiency in motor vehicles and energy-using household equipment.

BC Hydro's Collaborative Committee has been established to help the utility estimate the electricity conservation potential in the province. This committee, representing 34 organizations, is first determining the maximum amount of conservation possible and then it will estimate what is achievable.

These efficiency and conservation initiatives indicate that the province is already on the path to a sustainable energy future, but we need to know more so we can achieve more. For example, at the present time we do not know the total potential energy savings from conservation and efficiency measures for all fuels.

Energy efficiency and conservation are clearly sustainability issues. Following the Round Table's sustainability principles, efficiency and conservation are preferred "sources" of energy. Reduction in total energy use reduces environmental impacts as well as minimizing depletion of energy stocks.

Lack of Energy Standards

The development of energy efficiency standards for new building construction and equipment, especially furnaces and other heating appliances, represents a relatively low cost approach to reducing energy waste. Such standards encourage the construction and use of more energy-efficient buildings and equipment, and can result in substantial cost savings throughout the life of the buildings and equipment. Efforts like these can also produce significant benefits to the economy because they are labour intensive.

Currently, British Columbia has no energy efficiency requirements for new homes or commercial buildings. Other jurisdictions including Ontario, Quebec, Alberta, and most U.S. states have minimum efficiency standards in place. The Ministry of Energy, Mines and Petroleum Resources is attempting to incorporate energy efficiency standards into the 1992 revision of the B.C. Building Code, although to date these have not been accepted by the B.C. Building Code Advisory Committee.

The provincial government enacted legislation governing appliances in June 1990. Since then, regulations for minimum efficiency levels have been introduced for a variety of equipment such as refrigerators, electric motors, electric and oil-fired water heaters, and natural gas furnaces and kitchen ranges. Oil-fired furnaces are notably absent from this list.

The current lack of building and heating appliance standards means that new homes are often built to standards that minimize the initial cost. The buyer must then bear the higher operating costs for the life of the building or appliance. In recognition of the savings over the long term, however, there are established ways of financing the purchase of an energy-efficient home.

Recommendation 5:
Government should ensure that energy efficiency standards are implemented without delay for new residential and commercial buildings and for all new heating appliances.

"Investment in electricity conservation instead of new generation should increase employment in British Columbia over the next 20 years by 11,859 person-years."

David Sims
Vancouver Resident
(Submission)

Encouraging Conservation

In the past, electrical and natural gas utilities did not have incentives to promote energy efficiency and conservation because their income depends on investment in infrastructure and in selling energy. For private utilities such as BC Gas and West Kootenay Power, every unit of energy sold increased shareholder profits, while every unit of energy saved through consumer energy efficiency programs reduced profits. To address the conservation disincentive for utilities, the British Columbia Utilities Commission is treating energy conservation on the same basis as other forms of approved capital investment. However, this ignores the fact that conservation is generally an environmentally superior alternative to producing and consuming additional energy.

Recommendation 6:
The British Columbia Utilities Commission should review criteria and incentives granted to utilities in other jurisdictions for conservation, and adopt progressive initiatives for energy utilities. In addition, it should consider allowing a financial premium on attainment of conservation by utilities.

Evaluating Conservation Programs

The province's electric and gas utilities are conducting their own energy efficiency and conservation programs. These are commonly referred to as "demand-side management" (DSM) programs because they affect the customer's demand for energy. These initiatives are important, but there is a need for better regulation of these programs.

Power Smart and other conservation and efficiency expenditures should undergo formal review and public scrutiny as would be required for a new generating project.

Despite utility and government programs, many consumers and businesses are still not aware of the benefits of increased energy efficiency. Homeowners often cannot identify the most energy-intensive appliances in their home. DSM programs have clearly not yet achieved their objectives and there is a need for better public information.

Using ratepayer revenues, BC Hydro is proposing to increase its investment in the Power Smart program to $600 million over the next 20 years. This investment in Power Smart is being treated as a resource equal in stature to a new power plant, but without rigorous examination

by the British Columbia Utilities Commission. As is common in other jurisdictions, Power Smart and other conservation and efficiency expenditures should undergo formal review and public scrutiny as would be required for a new generating project.

Recommendation 7:
Ongoing rigorous evaluation of energy efficiency and conservation program planning should be ensured by the British Columbia Utilities Commission for regulated utilities. In addition, such evaluation should be incorporated in a more comprehensive energy planning process in the province.

Reduce, Reuse, Recycle

The high level of energy "embedded" in most major exports from British Columbia *(see Figure 2)* demonstrates the importance to energy conservation of reducing the use of, reusing and recycling materials.

Reusing a material requires essentially no new energy. Making recycled materials often takes only half as much energy as producing them new.

For example, refilling a container uses little energy. Recycling a discarded container uses more energy than refilling, but often significantly less than making the container from raw materials. When compared to the energy required to make an original container from raw materials, recycling can produce an energy saving of about 30 to 35 per cent for glass and steel containers, 60 per cent for plastic and 70 per cent for aluminum. However, the total possible energy saving for British Columbia is unknown.

Difficulties in capturing these potential savings include the following:

- the rate of return from the consumer is sometimes low;
- the market is sometimes not strong enough to absorb the supply; and
- the cost of transportation to the recycler sometimes makes the option uneconomical.

"An increasing B.C. population and expanding industrial base may well justify further and expensive future hydro energy development. On the other hand, efficient conservation programs that reduce existing demands can free available energy for other functions."

Derrick Mallard
Citizens Association to Save the Environment
(Submission)

Reusing a material requires essentially no new energy. Making recycled materials often takes only half as much energy as producing them new.

The Ministry of Environment, Lands and Parks has recently established several programs to reduce the amount of solid wastes. These include an environmental recycling and waste reduction industries program to promote the creation and application of innovative waste reduction technologies by B.C. industries. This program offers opportunities to achieve energy conservation and other environmental benefits.

Recommendation 8:

Energy conservation programs should emphasize the importance of reducing the use of, reusing and recycling materials. Waste reduction programs should identify to the public the potential energy savings through waste reduction.

CHAPTER 4

Alternative Energy Technologies

Background

Development of energy alternatives offers the promise of cleaner energy for the future. Biomass energy, advanced coal technologies, fuel cells, hydrogen fuels, geothermal energy, ocean (tidal and wave) energy, solar energy, and wind energy are some of the alternatives that can contribute to a cleaner environment. However, such alternative technologies must be cost competitive and, at the current time *(see Figure 4)*, the apparent economic cost is a deterrent to widespread use.

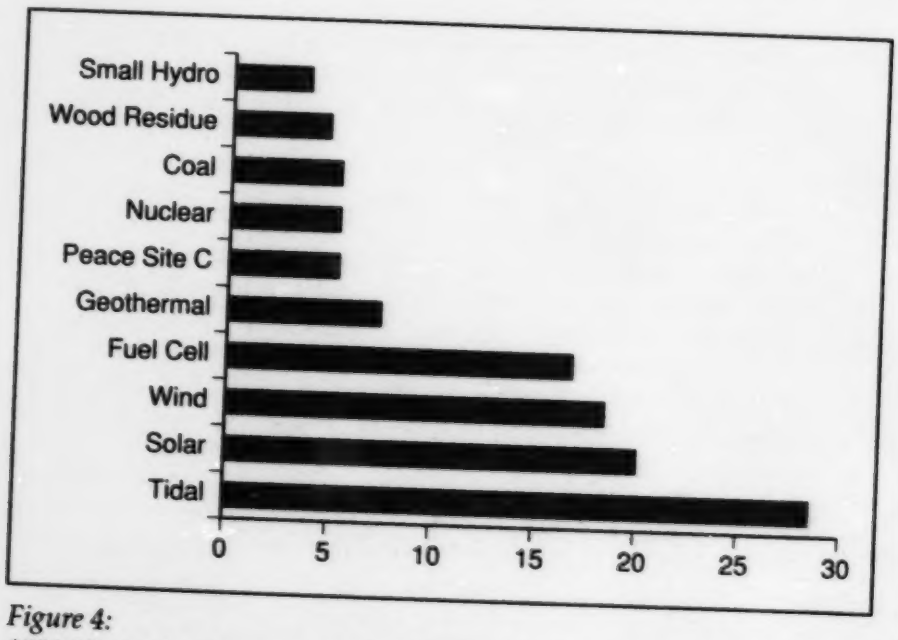

Figure 4:
1990 Electricity Costs (not including full environmental costs)

Source: B.C. Hydro, 1990

Development of energy alternatives offers the promise of cleaner energy for the future.

"Natural gas should continue to be promoted as a clean burning alternative fuel in domestic markets. It is an excellent bridge between less clean petroleum based products and future fuels such as hydrogen."

Bob Clarke
Fort St. John & District Chamber of Commerce
(Submission)

Biomass Energy

Biomass energy, derived from wood and plant residues, can be burned directly, or converted to alcohol fuels or biogas which is produced by bacterial digestion of biomass. Concern over global warming may restrict this option, although it may be viable where it can efficiently replace other fuels and be shown to reduce environmental impacts.

Advanced Coal Technologies

Advanced coal technologies are currently being developed. The integrated gasification combined cycle (IGCC) process, for example, could provide much cleaner emissions from coal-fired thermal power plants. Given British Columbia's 500+ year reserves of coal, this and other advanced coal technologies may open up new possibilities within the decade.

Fuel Cells

Fuel cells work like batteries, in that chemical energy is converted directly into electrical energy without combustion. Unlike batteries, however, fuel cells use energy supplied from outside the cell (i.e. hydrogen from methanol). A key advantage of a fuel cell is that it produces electricity with much greater efficiency than that achievable with conventional thermal generation. The technology can be used in both stationary and mobile applications using electric motors and methanol. Fuel cell technology is currently being developed in North Vancouver and should offer commercial possibilities by the late 1990s.

Hydrogen

Hydrogen is typically found in combination with other elements, such as in water (hydrogen and oxygen) and in natural gas (hydrogen and carbon). To obtain pure hydrogen, it is necessary to use energy to break the bonds with the other elements. It may be economically produced from natural gas or methanol, or through the electrolytic process using water and surplus electricity.

Hydrogen is a very attractive fuel because it contains a great deal of energy for its weight and because its combustion byproducts are significantly less polluting than with conventional fuels. It is already in limited use to fuel urban transit and is well suited for aviation fuel because of its high energy content. However handling and storage currently present significant difficulties, and it is not expected to receive widespread use until well into the next century.

Geothermal Energy

Geothermal energy refers to the natural heat of the earth. In certain cases, it can be extracted from naturally occurring steam and hot water. Geothermal energy offers an enormous potential, but it is difficult to capture and there are significant environmental problems in some cases.

Many countries use geothermal energy for residential and commercial space heating, agricultural and industrial purposes, and electrical generation. In the early 1980s, BC Hydro and the federal government investigated the geothermal potential of Meager Creek, north of Pemberton. The project has since been pursued by private interests.

Ocean Energy

Ocean energy refers to tidal energy, wave energy, or the extraction of energy from thermal gradients. In Canada, the Bay of Fundy produces tidal energy, and several sites in British Columbia were studied in the early 1980s.

Solar Power

Many types of solar power systems are currently used for space and water heating and for conversion to electricity. Home builders infrequently take advantage of solar energy for space and water heating even though cost-effective technology is currently available. On the other hand, electricity from solar energy converted by photovoltaic cells is currently relatively expensive.

Heat Pumps

Heat pumps extract energy from the environment (air, soil and water). Even though the technology is established and is cost-effective, it is often overlooked as a viable alternative to conventional heating systems.

Wind Energy

Wind is the energy motion of the earth's atmosphere. The amount of energy that can be extracted from a windmill increases dramatically with the speed of the wind making it very site sensitive. Wind turbine technology is well developed with significant capacity installed worldwide. The wind resource in British Columbia has not been fully assessed, but costs are estimated to be two to three times BC Hydro's system costs. Wind energy may therefore be economical only in certain cases to complement diesel-electric operations in remote parts of the province.

Nuclear Power

Nuclear power is a controversial option that the province does not need to consider given our abundance of competitive power sources.

Comparative Costs

The problem with most energy alternatives is that at present, they are not economical *(see Figure 4)* when compared with conventional energy forms. This is partly due to the fact that environmental and social costs are generally not included in the price of conventional energy forms as

"Neither hydroelectric projects that flood and destroy large areas of renewable resources, nor hydrocarbon consumption is part of a sustainable future. We have to go the route of alternatives like solar, heat pumps, wind, tide, wave, and/or ocean thermal".

Randal Hadland, Peace Valley Environmental Association (Submission)

discussed in the next chapter. Research and development would help to reduce the costs of these alternative technologies so that they will be more widely used in the future.

Research and Development of Energy Alternatives

British Columbia has an opportunity to convert its comparative advantages in energy resources into a comparative advantage in energy technologies and expertise.

The use of conventional energy technologies creates both benefits and costs from social and environmental perspectives. Improving existing technologies and developing new ones could significantly increase the benefits and reduce the costs, while creating economic opportunities at the same time.

British Columbia has an opportunity to convert its comparative advantage in energy *resources* into a comparative advantage in energy *technologies and expertise*. For example, cleaner coal technology and related skills could be developed and exported to other countries. Similarly, we are leaders in developing new technology for natural gas engines and for hydrogen fuel cells. This expertise, whether based on conventional or alternative energy technologies, can benefit the environment in British Columbia and elsewhere while providing significant economic advantages to the province.

The private sector should be expected to finance its own research and development activities, but it is generally accepted that government should encourage and enhance research. However, there are public concerns that government funding programs for research and development sometimes are not successful and occasionally repeat work being done elsewhere.

There is also the question of how such research should be funded. The Core Group's conclusion is that industry should provide the majority of funding. Government could provide its share through an Energy Sustainability Trust Fund with funds raised through a small levy on energy consumption.

Governments can assist industry in marketing newly developed capabilities, as is now happening through the British Columbia Science Council's SPARK program. This initiative is strategically important to the province, given the importance of the energy industry to our economy and the world-wide efforts to reduce pollution from energy use.

Since some alternative energy technologies will better protect the environment and offer opportunities for sustainable economic growth, the following recommendations are made:

Recommendation 9:
Government should promote more actively the adoption of existing alternative energy technologies which are economically and environmentally beneficial.

Recommendation 10:
Government should review existing federal and provincial programs designed to assist industry in financing innovative energy technologies for both conventional and alternative energy sources, and develop a comprehensive program specifically to assist those technologies of demonstrated value for energy sustainability.

Recommendation 11:
Government should consider establishing an Energy Sustainability Trust Fund, based on a small levy on energy consumption, to provide funding for an alternative technology program.

Recommendation 12:
Government policy should support development of environmentally superior applications of fossil fuels and of leading edge skills to assist users in adopting them.

Recommendation 13:
Government should give high priority in international trade promotion activities to sustainable energy technologies developed in British Columbia.

Incentives for Environmental Improvements

Wood residues are the bark and sawdust that normally cannot be used in the forest products industry. Approximately 30 million cubic metres of wood residues are incinerated annually in British Columbia in about 100 beehive burners. Using the residues in a power plant significantly reduces total emissions and extracts energy that is otherwise wasted.

"The goal of the city of Williams Lake in 1987 [concerning the Williams Lake wood residue power project] was to clean up the environmental problem and at the same time create an economic opportunity in doing so."

Hugo Stahl
City of Williams Lake
(Submission)

Power facilities using wood residues as fuel have demonstrated their ability to produce energy and, in many cases, to alleviate existing environmental problems caused by the disposal of residues from the forest products industry. For example, a new power plant that is being built in the Williams Lake area is expected to improve local air quality resulting from the burning of wood residues in inefficient beehive burners.

The provincial government has a policy to allow an "environmental price premium" for energy from wood residue projects that yield local environmental benefits. Under the policy, BC Hydro will offer a price premium of up to 25 per cent over its normal price for power purchased from qualifying projects.

Until recently, little incentive was given to industry to develop energy alternatives such as wood residues for power production. In principle, the idea of giving premiums for energy alternatives that yield site-specific environmental improvements is a good one. However, the concept should be broadened into a consistent, comprehensive policy regarding alternative energy projects in British Columbia.

The existing policy applies only to power generated from wood residues. Energy generation through the burning of some wastes — municipal solid waste for example — may raise different environmental problems, such as the disposal of contaminated ash.

Nevertheless, the policy should be expanded to other fuels and alternative technologies where a net environmental improvement would occur and the economic cost is close to that of a conventional source of energy.

Until recently, little incentive was given to industry to develop energy alternatives such as wood residues for power production.

It is preferable to be able to choose a particular energy option on the basis of its comparative costs, rather than relying on a system of incentives as in the present policy. However, this is currently impossible because electricity prices do not include an assessment of all environmental costs, as discussed in the next chapter.

If cost-based comparison was possible, allowance would have to be made for those site-specific circumstances where the energy project would actually provide an environmental improvement. In such an instance, the value of the environmental benefit might be determined explicitly, if possible, or it might be estimated (perhaps up to 25 per cent as in the current policy).

Finally, an expanded policy should require that the decision-maker explicitly consider the long-term sustainability of the proposed project. For example, woodwaste power projects should be promoted where they produce environmental benefits. However, it would not be wise to over-commit to wood residue as an alternative energy source over the long term, since technological improvements might result in less residue from sawmills.

An expanded policy should require that the decision-maker explicitly consider the long-term sustainability of the proposed project.

Recommendation 14:

Government should broaden the existing "environmental price premium" policy for electricity purchases to:

- **include any alternative energy that can be shown to produce a net environmental improvement;**
- **base the premium on the full cost of such energy once the appropriate information is available on the full costs of conventional sources; and**
- **ensure that application of the policy is guided by consideration of long-term sustainability.**

CHAPTER 5

Energy Pricing

Background

The pricing of energy resources is an important issue in determining a sustainable energy strategy for British Columbia. Prices have a direct impact on the amounts of energy consumed and conserved by British Columbians. They also affect the types of energy provided by suppliers, including both conventional supplies and alternatives, and influence consumers' choice of fuels.

Energy prices affect not only the amount of energy consumed but also consumer choices among competing energy types.

Defining energy prices that are consistent with sustainability is a complicated task. Prices should:

- ensure that consumers have access to secure and affordable energy supplies;
- discourage the wasteful use of resources and promote efficiency in both energy production and use;
- discourage environmental damage and encourage the development of cleaner energy sources;
- recognize that industrial competitiveness is essential to our economy;
- provide a reasonable return to energy suppliers and foster new supply sources; and
- provide a fair return to the ultimate owners of the energy resources, the people of British Columbia, through the provincial system of taxes and royalties.

Present government policy permits energy markets to determine prices as freely as possible, with the exception of electricity. At the same time it protects consumers from potential monopoly power through regulation. This policy reflects a trend towards increased competition in energy supply. However, the government still has some key policy levers, including taxation and environmental standards, to ensure energy pricing is in line with sustainable energy objectives.

Energy pricing in British Columbia is determined in different ways, reflecting the varied structure of the industry itself. Prices of heating oil and other oil products are set through competitive market forces, and are inextricably linked with events in the world oil market.

Natural gas prices are also market determined at the supply level or wellhead, although retail prices are regulated by the British Columbia Utilities Commission through the *B.C. Utilities Commission Act*. Since these prices are related to market conditions, price changes tend to reflect supply costs.

Electricity prices are not market determined. They are regulated under the *B.C. Utilities Commission Act* at all levels — generation, transmission, and distribution. This process effectively bases electricity rates upon historical costs of infrastructure. However, costs of power from new sources will be much higher than the historical costs on which current prices will be. Therefore, today's user receives an inappropriate price signal that encourages a decision to use more power.

Provincial Revenues from Energy

The oil, natural gas, coal and water that are our energy sources are owned by the provincial government. In exchange for the rights to produce energy, the Crown levies various resource royalties and land payments on behalf of the citizens of British Columbia.

In the case of hydroelectricity, the provincial government charges water rentals on the generation of power. BC Hydro also pays a dividend to government, as a return on public equity held in the corporation. It also pays grants to municipalities in lieu of property taxes on land. Royalties, land bonuses and mineral taxes are paid on oil, natural gas, and coal as the government's return from the value of these commodities. In 1989, direct government revenues from energy production and use totalled $1.2 billion.

Full-Cost Accounting

"Energy prices must include a component for environmental damage and research on other energy sources."

Arlene Galinsky
Prince George Resident
(Submission)

Today's energy prices do not incorporate the full environmental costs of energy supply and use. In some cases, prices do include the costs of meeting current environmental regulations. However, current requirements for mitigation and compensation do not identify the cost or otherwise capture the full environmental impacts caused by the energy sector from production to end use. In the language of economics, the residual environmental costs represent an "externality" since they are not reflected or captured in energy prices.

A major outcome of the fact that energy prices fail to reflect full environmental costs is insufficient investment in energy efficiency. Industry will not invest optimally in efficient plant and equipment, households will not buy efficient appliances and builders will not construct homes that are well insulated when there is no economic incentive to conserve energy.

Using energy wisely is in the interest of both the environment and the economy and will benefit all British Columbians. Even with a higher unit price for energy, proportional costs to both industry and individual consumers could be kept at present levels through greater efficiency and reduced consumption.

At the same time, environmental damage could be minimized through energy efficiency. In the absence of full cost accounting, energy-efficient practices can only be promoted through programs such as Power Smart and government standards. While these are important initiatives, the most effective signals to energy consumers and suppliers may be prices and marketing strategies that encourage conservation.

Using energy wisely is in the interest of both the environment and the economy and will benefit all British Columbians.

Energy prices affect not only the amount of energy consumed, but also consumer choices among competing energy types. There is inconsistency in the degree to which environmental costs are currently captured in the consumer prices of various fuels. Certain energy forms, electricity and natural gas in particular, may appear easier to subject to full cost accounting because their prices are already regulated. Other fuels such as oil are priced according to market pressures, with the result that it may be more difficult to capture the environmental costs in the end price.

Differences in the level of accounting for environmental cost can affect fuel choices. Consumers wish to make informed and responsible energy decisions, yet they must base their choices on market price. Clearly, those prices should reflect the full costs to society of using each fuel type.

For example, BC Hydro and the province's natural gas utilities are involved in joint "fuel switching" programs to encourage builders and consumers to choose natural gas for space and water heating in gas service areas. While this may be the correct choice, it is important that the public be aware of the full environmental and economic costs of both hydroelectricity and natural gas when determining whether this fuel switching program is beneficial.

Differences in the level of accounting for environmental cost can affect fuel choices.

Steps to Full-Cost Accounting

A first step toward full-cost accounting will involve a comprehensive examination of the current provincial system of energy taxes and levies to determine the extent of taxation for all energy forms. This review is necessary to ensure a fair and equitable distribution of the costs and benefits associated with energy production and use. For example, there is currently an exemption of provincial sales tax on residential electricity sales although it is charged on all other energy sales. The review would also ascertain the extent to which environmental costs may already be incorporated for some energy forms.

The second step toward full-cost accounting is evaluation of all environmental costs and benefits to the greatest possible extent. This can be done in a number of ways.

To account for hidden environmental costs, the provincial government and BC Hydro have factored in simple percentage increases to the cost of energy resources for planning purposes. This practice is preferable to having no environmental costs calculated, and may be quite appropriate for some costs that are difficult to quantify. A superior practice, however, would be to estimate as completely as possible the full costs for each energy type.

This second step should begin with a generic evaluation of environmental costs for all current and anticipated energy types. Without such a calculation, it is presently very difficult to properly evaluate one form against another. As a result, today's decisions on new energy projects are being made on a project-by-project basis, without full consideration of whether the right energy form has been chosen from economic, environmental and social perspectives.

The third step towards full-cost accounting would be to incorporate the environmental costs into energy planning and market prices. The objective would be to improve decision-making on the development and use of energy, without creating economic difficulties for the residential consumer or for industry.

Recommendation 15:

Government should review existing taxes and royalties on all forms of energy to ensure that costs and benefits are distributed equitably and fairly, and to determine the extent to which environmental costs are currently incorporated for each energy form.

Recommendation 16:
Government should ensure that the costs of environmental impacts are thoroughly evaluated as far as possible for all forms of energy produced or consumed in British Columbia

Recommendation 17:
Government should take steps to include these environmental costs into energy planning and market prices for new energy projects.

Recommendation 18:
Environmental damages for which costs cannot practically be assigned should nonetheless be fully taken into account in energy planning.

Electricity Rates and Consumption Levels

Currently in British Columbia, some electricity rates are based on a declining block structure. In these cases, successive units of energy consumed become cheaper *(see Figure 5)*. This type of rate structure encourages customers to use more electricity.

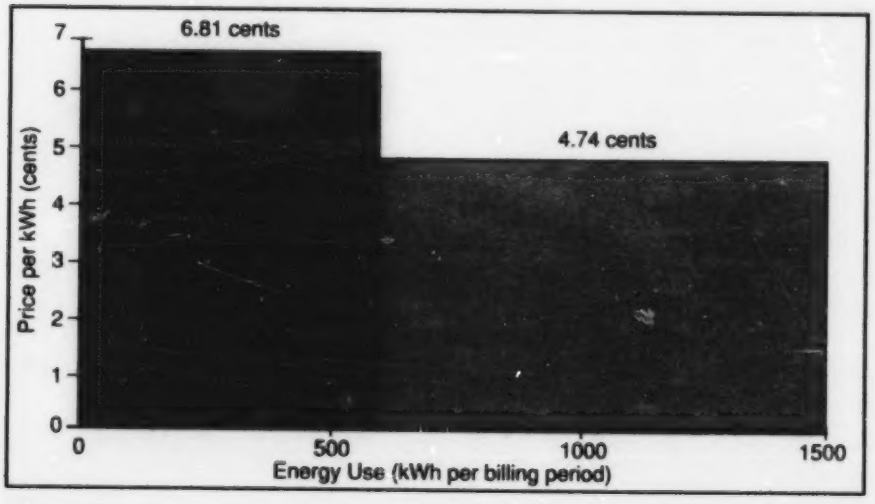

Figure 5:
B.C. Hydro Residential Declining Block Rate, 1991

Source: B.C. Hydro Electric Tariff

"British Columbia energy policy should encourage the efficient use of energy, but at the same time it should not cause costs to rise significantly above those in competing jurisdictions. Not only would this have a significant detrimental impact on British Columbia's economy, but could also give the perverse effect of shifting the production of energy-intensive goods to jurisdictions which are more heavily dependent on dirtier or more hazardous fuels."

Lorne Sivertson
Ministry of Regional and Economic Development
(Submission)

An inverted rate structure could be designed to be revenue neutral which would lower the cost of basic services.

In some other jurisdictions, such as California, increasing or "inverted" rate structures have been implemented that provide a lower initial rate for basic electricity use and a higher rate for consumption above the basic level. The higher rate is designed to discourage excessive use. It is typically based on the incremental or "marginal" cost of electricity supply, that is, the cost of electricity from the next new project.

Electricity rates for industrial customers do not use a declining block. They reflect the utilities' cost structure, but vary with the customer's load factor. The higher the load factor, or the percentage of the customer's connection capacity that is used, the lower the average electricity rate.

BC Hydro has proposed new negotiated rates for industry, including an inverted structure, in which the second energy block would be priced at the utility's long-run marginal cost. These rates may benefit those industrial customers who are able to generate their own power, install energy-efficient equipment, or otherwise reduce their demands on the BC Hydro system.

The provincial government has directed the British Columbia Utilities Commission to ensure that BC Hydro rates "be gradually increased to meet the higher costs of new electricity supply". The intent of this directive was to make BC Hydro's rates better reflect current market conditions of rising supply costs. BC Hydro's 1990 rate increase proposal was rolled back by the Utilities Commission, and BC Hydro was instructed to reassess its rate structure with a view to eliminating declining block rates for residential and commercial customers. In January 1991 the utility submitted a Rate Design Application to the Utilities Commission that included a proposal to move prices gradually in the direction of inverted rates. The issue of electricity rate design is currently under review by the Utilities Commission.

This new direction in pricing policy is strongly supported from a sustainability perspective, but it should be implemented carefully. Inverted rates could increase the electricity bills of lower income home owners and small businesses. This can be overcome by designing the new rate structure to be revenue neutral which would lower the cost of basic services. Inverted rates could also result in significant increases in electrical heating costs during periods of cold weather if bills are not averaged through an annual cycle.

Recommendation 19:
Government and the British Columbia Utilities Commission should compel all electric utilities to move gradually from "declining block rates" to "inverted block rates" that would provide a lower initial rate and a subsequent higher rate priced at the full marginal cost.

Regional Pricing

One of the implications of pricing energy resources to reflect their true cost of supply is that there may be justification for regionally-differentiated prices across British Columbia. To a certain extent, this is already the case for natural gas prices which vary with distance from the wellhead. Electricity prices, on the other hand, are determined on a "postage stamp" basis, with province-wide rates for a given customer class.

Regional power rates would recognize the real costs and benefits of supplying the energy and give a cost-based advantage to customers who are located close to the energy source.

Regional power rates would recognize the real costs and benefits of supplying the energy and give a cost-based advantage to customers who are located close to the energy source. This has the advantage of recognizing the potentially lower economic and environmental costs of the electricity supply system in certain areas, and would be a considerable benefit in developing the economy of northern British Columbia and the Kootenays.

Regional pricing is being promoted on a limited basis through BC Hydro's transmission policy. "Wheeling", a utility term for transmission of electricity across high voltage transmission facilities, would allow industrial customers to use BC Hydro's transmission system. Customers might purchase lower cost power from private generators located throughout the province.

It is recognized, however, that the economic, environmental and social implications of a regional pricing policy must be carefully studied.

Recommendation 20:
Regional electricity pricing should be considered as a new policy following a comprehensive evaluation of environmental, social, and economic impacts.

CHAPTER 6

Energy Exports

Background

The issue of energy exports is central to any discussion of energy sustainability. Energy exports generate considerable economic benefits, while raising questions about depletion of domestic supplies and unwanted environmental impacts.

Exports are an important source of revenue for energy suppliers. As shown in Figure 6, energy exports in 1989 were worth $2 billion to British Columbia. Energy exports also contribute to the $1.2 billion of direct government revenue from energy production. They provide system efficiencies that improve the energy supply infrastructure, such as pipelines and transmission systems, and lower supply costs to British Columbians. As noted earlier, energy is also embodied in many of the province's material exports *(see Figure 2)*.

Exports of electricity and natural gas are regulated through the provincial government's Energy Removal Certificate process, which requires that exports be surplus to domestic needs and in the public interest. In addition, any power projects to be built for the firm export market are subject to the provincial Energy Project Review Process.

Energy Form	Value
Coal	$ 1.6 billion
Natural Gas	$ 0.2 billion
Electricity	$ 0.1 billion

Figure 6: Energy Exports in 1989

Source: Energy Exports in 1989.

The majority of electricity exports to date have been made on a short-term, interruptible basis from surplus hydroelectric generation available during high water years. In 1988 the provincial government established a subsidiary of BC Hydro called POWEREX to develop a power pool and new supplies for the long-term export of firm power from thermal and hydroelectric generation. POWEREX proposes to facilitate export sales by providing wheeling and other services.

Traditionally, British Columbia natural gas has been exported to the United States. Exports are currently being encouraged, in part, to stimulate exploration and development which cannot be justified for the domestic market alone. Major transmission projects underway within the United States will provide increased access to the large California market.

Coal is British Columbia's largest energy export, generating $1.6 billion in sales revenue annually. When coal is excluded from the energy export picture, the province is actually a net importer of energy because of our imports of oil products, primarily from Alberta.

The export of energy raises several questions from a sustainability perspective. The benefits from revenues and infrastructure supports must be balanced against questions of resource depletion and environmental impacts. The sustainability principles also imply that export policies and decisions must have a broad base of public understanding and support.

Exports of Natural Gas

The benefits from revenues and infrastructure supports must be balanced against questions of resource depletion and environmental impacts.

Recent natural gas deregulation initiatives and increased exploration activity have resulted in increased exports to the United States. The provincial government views these exports as helping to improve domestic security of supply by encouraging exploration and development activity to prove up reserves. In addition, exports can lower domestic gas costs by making better use of existing pipeline infrastructure and can help to develop further infrastructure in the province.

To the British Columbia public, gas exports are a concern due to implications for long-term security of domestic supply. British Columbia's current projected supply will last from 20 to 70 years at existing rates of extraction. From a broad regional perspective, natural gas exports may provide regional and global environmental benefits since exports to the United States are typically used to replace fuels such as oil and coal.

Recommendation 21:
Future government policy on the export of natural gas should be based in part on whether individual export proposals show a net positive balance in an environmental, economic and social evaluation.

Exports of Electricity

British Columbians worry about the export of firm electricity and about building electric power plants for export purposes. One of the main concerns of the public is that British Columbia might not be able to "retrieve" the exported power once it has been committed to the export market. A related concern is that the province might find itself with an ongoing requirement to export electricity once a precedent has been set.

Many British Columbians worry that the province will bear the environmental damages of exported electricity. BC Hydro's aging Burrard Thermal Generating Plant, a natural gas fired plant in the Port Moody area, has attracted a lot of local public concern. While the Burrard plant is used to support BC Hydro's domestic system, firm exports could result in increased operation of the plant, contributing to local air quality problems. The issue of thermal generation will become more important as BC Hydro arranges purchases from private power producers building thermal facilities for the export market.

Under current provincial policy, building for export will be limited to private power producers in British Columbia. The government intends that all environmental costs will be incorporated in the price of exported electricity and that environmental impacts will be addressed through the Energy Project Review Process. In addition, the power exports will have to be surplus to domestic needs and will revert to the province after 20 or 30 years.

Recommendation 22:
Electricity export decisions, including construction of export–dedicated facilities, should not be made or approved until they can be shown, through comprehensive planning with full public involvement, to be justified in light of sustainability principles.

"The export of electricity from hydroelectric sources will pose a number of serious problems for the Ministry, ranging from permanent loss of habitat to adequate pricing of non-market public goods. ...Promotion of electricity exports should, therefore, be approached with great caution."

J. O'Riordan
Ministry of Environment, Lands and Parks
(Submission)

Columbia River Downstream Benefits

The Columbia River Downstream Benefits (DSBs) refer to power generated in the United States as a result of dams built in British Columbia during the 1960s and 1970s. These power benefits belong to the provincial government and were sold under long term contract to buyers in the U.S. Pacific Northwest. Previous governments decided to repatriate the DSBs for use in the province. Scheduled to begin to return

to British Columbia in 1998, Columbia River power benefits represent an existing low-cost source of energy in comparison to new generation sources in British Columbia.

The specific magnitude of the DSBs depends on the rate of load growth in the U.S. Pacific Northwest. However, it is generally expected that at their maximum in 2003-4 they would be roughly equivalent to the output from the proposed Peace River Site C dam. The DSBs will continue until at least 2024 but will decline gradually after 2003-4.

The DSBs are a valuable supply source that can defer some of the need for new electricity sources in the province.

Options for disposition of the DSBs include selling them to provincial utilities, such as BC Hydro or West Kootenay Power, or using them to promote industrial development. The DSBs are a valuable supply source that can defer some of the need for new electricity sources in the province. However the issue of disposition raises significant public policy questions. Can British Columbians efficiently use this large source of energy in the near term? By taking a major amount of energy away from United States utilities, would we be causing them to advance their need for thermal generation, with consequent regional environmental impacts?

Recommendation 23:
The disposition of the Columbia River Downstream Benefits should be considered within a comprehensive energy plan for British Columbia that is developed in light of sustainability principles and with full public involvement.

CHAPTER 7

Energy Planning and Public Involvement

Background

Effective planning and public involvement are crucial elements in developing a sustainable energy future for British Columbia. Comprehensive planning, based on full public participation, is necessary to deal effectively with energy conservation, environmental impacts, pricing and other elements of a sustainability strategy for energy.

Recognizing Conservation

As discussed earlier, conservation and efficiency are preferred "sources" of energy. Currently in British Columbia there is no requirement that utility planning emphasize the role of energy efficiency and demand-side management.

Such a framework exists in the form of Integrated Resource Planning (IRP) or Least Cost Planning (LCP). IRP is a widely accepted integrated planning method that assesses the economics of all potential energy resources, including demand-side options, in order to meet customer energy needs. This method acknowledges that saving energy should be the first priority if the costs of saving are less than the costs of supplying new energy. Least-cost planning is now the common practice in most U.S. jurisdictions for electric utilities and is being extended to natural gas utilities in several states.

In British Columbia some utilities have adopted these planning principles. BC Hydro has incorporated some aspects of IRP into its decision-making framework — for example, by giving priority to customer and supply efficiency in the list of resource options. BC Gas has recently embarked on a progressive least-cost planning process. The British Columbia Utilities Commission has taken steps to formalize the provision of the BC Gas least-cost plan in June 1992. However at present

"The Ministry and BC Hydro advocate the use of least cost options provided that socioeconomic and environmental impacts are properly accounted for."

John Allan
Deputy Minister
Ministry of Energy, Mines and Petroleum Resources
(Submission)

there are no regulatory requirements in the province that ensure the thorough application of these essential planning principles for energy as a whole.

Decisions in a sustainable world must be based on full consideration of all practical alternatives, and a comprehensive evaluation of their comparative environmental, economic and social impacts. Integrated resource plans should be prepared by utilities and consistent IRP principles should be used when evaluating decisions involving competing energy forms — for example, when evaluating fuel switching between electricity and natural gas.

Recommendation 24:
Rigorous evaluation of energy efficiency and conservation, as an energy supply option, should be a requirement for all energy planning in British Columbia.

Recommendation 25:
The methodologies to be used for energy planning should be based on a complete economic, environmental and social evaluation.

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Integrating Environmental Impacts

Environmental impacts of many kinds arise at all stages of energy development and use. While these impacts have been recognized to some extent in energy planning in British Columbia, they are not being assessed in the comprehensive way that is essential to sustainability.

Hydroelectricity, although generally considered to be a renewable source of energy, results in major disturbances to land and water. Construction of seismic roads for oil and gas exploration and coal mines, electricity transmission lines, natural gas processing plants and pipelines also have a significant impact on land use. Oil can be a major water pollutant, through land-based and marine oil spills and dumping of contaminated bilge water from ships.

The burning of fossil fuels is associated with high-profile environmental issues such as global warming and acid rain. In the Lower Mainland, air pollution from automobiles is a particular problem, leading to increased health risks, producing crop damage and creating other environmental problems.

It is clear that the environmental impacts of energy use are cumulative in that there are impacts at all stages of the fuel cycle from exploration to transportation, distribution and end use. These impacts need to be assessed on a cumulative life-cycle basis and compared by fuel type to determine the comparative environmental impacts. Since this has not been done to date, it is difficult to make informed decisions when planning energy options.

A related issue concerns BC Hydro's intention to purchase electricity from privately owned generating facilities. British Columbians are concerned that there will be little opportunity for public input and a complete environmental assessment because some facilities are so small they might not be assessed under the Energy Project Review Process.

While comprehensive environmental assessments help with planning and project decisions, both proponents and decision-makers require predictable environmental standards. The provincial government has been criticized by the private sector for not establishing clear standards. This is a criticism not of the level of standards, but of the fact that regulations are not clear, predictable and consistent. Developers cannot plan projects efficiently without knowing what the standards are.

Recommendation 26:
Comprehensive environmental impact assessment should be a legislated requirement for both energy planning processes and energy development proposals.

Recommendation 27:
Government should ensure that clear, predictable environmental standards are established and updated, with full public and stakeholder involvement.

Sustainability Planning with Neighbours

Planning for energy sustainability requires cooperation with our neighbours. Energy policy options and their environmental impacts cross provincial and international boundaries. As well, the federal and provincial governments share responsibility for the environment.

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Environmental problems observe no jurisdictional boundaries. Fossil fuel-burning plants in the U.S. Pacific Northwest may be partly responsible for acid rain that falls on southern British Columbia, while

natural gas processing plants in the province may be contributing to acid rain in other areas. In some cases, as with carbon dioxide, the impacts of emissions are global in scale.

Given the transboundary nature of environmental impacts, the principles of sustainability suggest that British Columbians should adopt a global view on energy issues. This should encompass the effects of our energy use on other jurisdictions as well as the implications for us of resource decisions made outside the province. For example, installation of thermal generating plants in the United States could have consequences for air quality in British Columbia and vice versa.

British Columbia should actively promote cooperation with other jurisdictions to plan energy supply and to meet environmental objectives.

British Columbia should actively promote cooperation with other jurisdictions to plan energy supply and to meet environmental objectives. The provincial government has made a first step in this regard by signing an international Energy Agreement to exchange information with Washington State. BC Hydro has made power coordination agreements with utilities in Alberta and the U.S. Pacific Northwest. Efforts such as these should be expanded in the coming decade.

Provincial/Federal Cooperation

Jurisdictional issues also arise due to the shared responsibility for the environment between federal and provincial governments. Environmental assessment processes are a particular focus of attention. Environmental reviews of energy and energy-using projects in British Columbia are conducted under the three provincial review processes. The Energy Project Review Process covers power plants, transmission lines, and pipelines. The Mine Development Review Process covers mine developments. The Major Project Review Process is designed to evaluate other major projects.

The first two of these processes are covered by legislation, but the Major Project Review Process is not. Important elements of each process are ensuring that all environmental impacts of proposed projects are identified and assessed, that sound environmental design is built into successful projects, and that projects are constructed, operated, and decommissioned in keeping with government standards.

At the same time, the federal government is now implementing the Canadian Environmental Assessment Act. This Act will require mandatory federal environmental assessments of all projects that are initiated by a federal agency or Crown corporation, or which are situated on federal land, require federal approvals or permits, receive federal assistance, or involve federal status (such as fisheries).

With the introduction of this Act, it may become necessary to carry out the federal environmental review process in addition to provincial processes. This could result in considerable overlap between provincial and federal regulatory requirements and could create unreasonable delays and uncertainty for project proponents.

The provincial review processes themselves could be improved, with a view to cooperation with the federal review process, through measures such as:

- providing a legislative basis for all of the processes;
- providing uniform procedures;
- increasing public participation;
- avoiding duplication with the federal process by the use of joint panels;
- introducing mediation to help reach agreements; and
- monitoring to follow up decisions.

Recommendation 28:
Government should undertake formal cooperative energy sustainability planning with neighboring jurisdictions.

Recommendation 29:
The provincial government should seek ways to coordinate or unify environmental approval requirements.

Greater Public Involvement

A clear requirement for an energy sustainability strategy is effective public involvement. This should happen at all stages: setting public policy goals, developing plans, assessing project proposals and reviewing project implementation. The benefit of effective involvement is that it can ensure public contribution to goals, plans and decisions, as well as public support in implementation.

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The public has made it clear, through input to the Round Table and through reaction to energy projects such as the proposed natural gas storage project in the Lower Mainland, that it wants to be more directly involved. Some consider existing opportunities to be inadequate; for example, the B.C. Utilities Commission process of public hearings is considered by some to be too formal and narrow in focus. Alternatives to the traditional practice of public hearings must be found.

Improving public information and education is the first step, but a firm commitment to full public involvement and collaboration is required. In practice, the need for public collaboration on energy issues can be met in a variety of ways. Better ways need to be found to inform the public about major issues and energy options so they can participate in a knowledgeable manner. The public also needs better opportunities to participate in discussions on the choice of options and they need the information and opportunity to ensure accountability in decisions and implementation.

Publishing discussion papers is one way of improving information on current energy issues. In the U.S. northwestern states, the Northwest Power Planning Council publishes issue papers on important energy topics, as well as a bi-monthly magazine and a monthly newsletter to involve the public more fully in decision-making. Part of a formalized public involvement process for British Columbia might be the regular dissemination of issue papers on such topics as:

"Public involvement is needed in evaluating the environment and in establishing energy supply options."

Joan Vance,
British Columbia Public Advocacy Centre
(Submission)

- energy export options and issues;
- energy pricing and environmental taxes;
- transboundary environmental impacts of energy;
- global warming impacts and strategies; and
- comparative environmental impacts of energy projects.

Local discussion of these issues and related energy decisions could be accomplished by regional or local round tables or other similar bodies. The Round Table has recommended that local round tables be fostered to assist in meeting sustainability objectives. Among their tasks, these regional bodies would work to promote public education and actively solicit public participation in decisions about resource use.

Recommendation 30:
Government should legislate defined, effective and mandatory public involvement in energy planning and project assessment as soon as possible.

Energy Sustainability Planning

At this time there is no comprehensive long-term energy planning for British Columbia.

The majority of electricity planning in the province is carried out by BC Hydro and West Kootenay Power. Natural gas supply planning is undertaken by local distribution utilities such as BC Gas and the main transmission company, Westcoast Energy. Planning for oil and refined petroleum products, such as gasoline and diesel, is carried out by private oil and pipeline companies. There is, however, no planning which coordinates electricity, natural gas, oil and energy alternatives from the perspective of sustainability.

At this time there is no comprehensive long-term energy planning for British Columbia.

There are also specific concerns about predictability and accountability in electricity planning. Recently, BC Hydro's annual resource plan has undergone some dramatic changes. The utility has increased its planned resources of demand-side management and private power purchases, delayed the development of major new hydroelectric resources, and assumed the availability of the Columbia River Downstream benefits for its own use.

Energy Plans

Development and regular updating of a British Columbia Energy Plan would be of great assistance in achieving coordinated energy planning with full consideration of sustainability issues and options. Biennial energy plans are developed by both the Northwest Power Planning Council and the California Energy Commission. In California, the state government produces detailed biennial reports on specific energy forms (fuels, electricity and energy efficiency), which are incorporated in the overall biennial energy planning report.

These plans could be prepared with public and stakeholder collaboration, based in part on published energy issue papers. Energy plans would serve to guide and assess energy decisions, and could:

- address all energy types;
- assess efficiency and conservation measures against targets;
- assess alternative energy technologies and set directions;
- compare environmental impacts of all energy options;
- address both domestic and export supply and demand issues; and

- provide province-wide coordination of individual utility integrated resource plans and demand-side management plans, including linking provincial initiatives (e.g. minimum energy efficiency standards for buildings and equipment) to local government and utility actions.

An Energy Planning Council

A British Columbia Energy Plan should be prepared by an advisory organization to the provincial cabinet, that is not involved in making energy decisions, that has an arm's length relationship to government, and that has broad-based public representation. It is the Core Group's conclusion that an Energy Planning Council needs to be created by the government to provide this forum. The mandate of the Council should be to:

- prepare an energy plan for British Columbia, and update it every two years;
- determine energy conservation potential for the province;
- provide advice on sustainable energy options, preferred directions, and targets;
- recommend energy planning methods;
- provide a comprehensive assessment of environmental impacts for various energy forms;
- recommend a costing system by which energy options would be compared; and
- inform and involve the public in the major energy issues affecting British Columbia.

Recommendation 31:

An Energy Planning Council should be established, with appropriate staff and funding, to conduct independent, comprehensive energy sustainability planning with full and continuous public and stakeholder involvement.

"The Peace Valley Environmental Association supports the concept of a provincial power planning council. The council should be composed of utilities, user groups, builders' associations, environmentalists, native groups, and academics."

Randel Hadland, Peace Valley Environmental Association (Submission)

CHAPTER 8

A Sustainable Energy Future

British Columbia has already taken some major steps towards energy sustainability. The strategy outlined in this report would augment those initial steps and put British Columbia well on the road to energy sustainability.

What will a sustainability strategy for energy mean in practical terms for British Columbians? Will we have to make fundamental changes? What does a sustainable energy future look like?

A sustainable future will include full recognition that providing energy to society has significant impacts on the living world. Steps will have to be taken to ensure that the natural world's carrying capacity is not threatened or exceeded. The strategy presented here suggests immediate steps towards curtailing emissions of greenhouse gases and development of cost-effective plans to allow further actions to be implemented quickly. Improved energy conservation and efficiency measures and increased use of cleaner alternative energy technologies are suggested ways of meeting these goals. Every one of us can contribute to these goals, but government must lead the way.

Energy sustainability may mean different things to each of us since we each have our individual circumstances and values.

In a sustainable future, all of us will recognize that every step taken to conserve energy and use it efficiently will ultimately help preserve and protect the environment. Each individual's use of energy will be far lower than today, yet we will be able to enjoy the same energy services. Energy productivity, measured as dollar output per unit of energy consumed, will be higher.

In a sustainable future, British Columbia companies will actively seek several alternative energy technologies, both as improvements for current energy sources and as new energy sources. These will allow us to use non-renewable energy sources wisely, as bridges to new technologies with low environmental impacts.

In a sustainable future, energy prices will help us to make better energy choices through such mechanisms as incorporating environmental costs

in the price of new energy projects and inverted electricity block rates. These policies promote efficiency and conservation, and encourage the early development of alternative technologies. Prices would also better reflect a fair distribution of the benefits and costs of the resource use through such measures as regional pricing. While these initiatives would tend to increase the average unit price of energy, basic services could be provided at lower cost. The total energy bill could be equal to today's because of the lower demand for energy due to efficiency and conservation measures.

Ultimately it will be up to us, individually and collectively, to decide the shape of our sustainable future.

In a sustainable British Columbia, economic development will be more heavily based on industries that add value to the same energy-rich resource products that we produce today. Some of these industries will tend to locate close to energy sources. This will increase the benefits to British Columbians from the existing stock of resources, and will put less stress on the environment for each dollar earned. Energy exports will continue to provide economic benefits to the province, and export decisions will be made with full public involvement as part of a provincial energy plan.

In a sustainable future, each of us will be better informed on energy issues and much more involved in reaching public decisions about energy use in British Columbia. Individual projects will undergo a single environmental assessment that satisfies the requirements of both the federal and provincial governments.

A provincial energy plan, developed in collaboration with the public by an independent agency, will guide decisions on individual projects. The plan will rigorously pursue energy conservation and efficiency as sources of energy. It will include a comprehensive environmental assessment for all types of energy to allow comparisons of impacts, and will provide the basis for British Columbia's involvement in cooperative energy sustainability planning with neighboring jurisdictions.

This vision of a sustainable energy future is not intended to be complete, but to provide a general idea of the ultimate impact of this sustainability strategy if it is implemented. Energy sustainability may mean different things to each of us since we each have our individual circumstances and values. Ultimately it will be up to us, individually and collectively, to decide the shape of our sustainable future.

How You Can Get Involved

The Sustainable Development Strategy Core Group of the British Columbia Round Table on the Environment and the Economy welcomes your comments on this paper, either in writing or by telephone. Please tell us your views on a sustainable energy future for British Columbia.

For more information, or to provide us with your comments, please contact:

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Bibliography

BC Hydro, 1990. *Electrical Issues for the 1990s.* BC Hydro, Vancouver B.C. 34 pg.

BC Hydro Electric Tariff, updated continuously.

Bridges, G.E., 1990. *Decision-Making Processes and the Energy Sector.* Background Paper prepared for the British Columbia Round Table on the Environment and the Economy, Victoria. 17 pg.

British Columbia Ministry of Energy, Mines and Petroleum Resources, 1990. *New Direction for the 1990s.* 23pg.

British Columbia Ministry of Energy, Mines and Petroleum Resources, 1991. *Energy Supply and Requirements Forecast 1990 - 2010.* Ministry of Energy, Mines and Petroleum Resources, Victoria.

British Columbia Ministry of Energy, Mines and Petroleum Resources, 1991. *Energy Market Update, March, 1991.* Victoria. 19 pg.

British Columbia Ministry of Environment, Land, and Parks, 1991. *Environment 2001 - Strategic Directions for British Columbia.* Victoria. 71 pg.

British Columbia Round Table on the Environment and the Economy, 1991. *Sustainable Development and Energy.* Victoria. 24 pg.

Edwards, W. C. Lee, N. Voigt, C. Chan, Y. H. and E. B. Peterson, 1990. *Carbon Dioxide Inventory for British Columbia.* Province of British Columbia Ministry of Energy, Mines and Petroleum Resources, Victoria. 95 pg.

McLachlan, M. and I. Itani, 1991. *International Comparisons: Interpreting the Energy/GDP Ratio.* Canadian Energy Research Institute. 122 pg.

Ngan, Patricia, 1990. *British Columbia Population Forecasts and Issues.* Background Paper for the British Columbia Round Table on the Environment and the Economy, Victoria. 18 pg.

Ottinger, R. L., D. R. Wooley, N. A. Robinson, D. R. Hodas, and S. E. Baff, 1990. *Environmental Costs of Electricity*. Oceana Publication, Inc. New York.

Science Council of British Columbia, 1988. *The B.C. Science Council Energy Sectoral Planning Committee Report*. SPARK Report, Vancouver. 48 pg.

Scientific American, 1990. *Energy for Planet Earth*. Special Issue September 1990. 184 pg.

Sivertson, L., 1990. *Energy and Economic Development*. Presentation to the Energy Workshop sponsored by the British Columbia Round Table on the Environment and the Economy, Vancouver, September 15-16, 1990.

Statistics Canada Labour Force Survey, 1990.